CEMENT AND LIME MANUFACTURE

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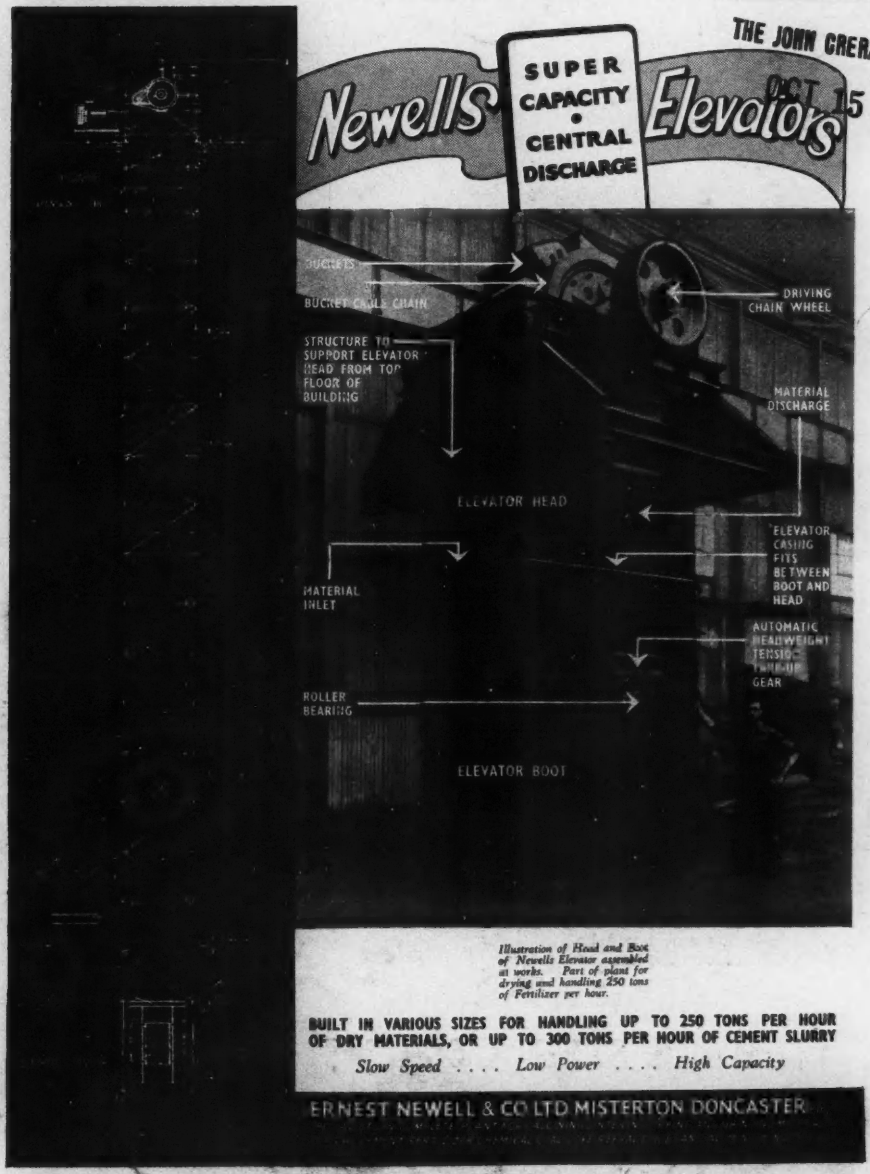
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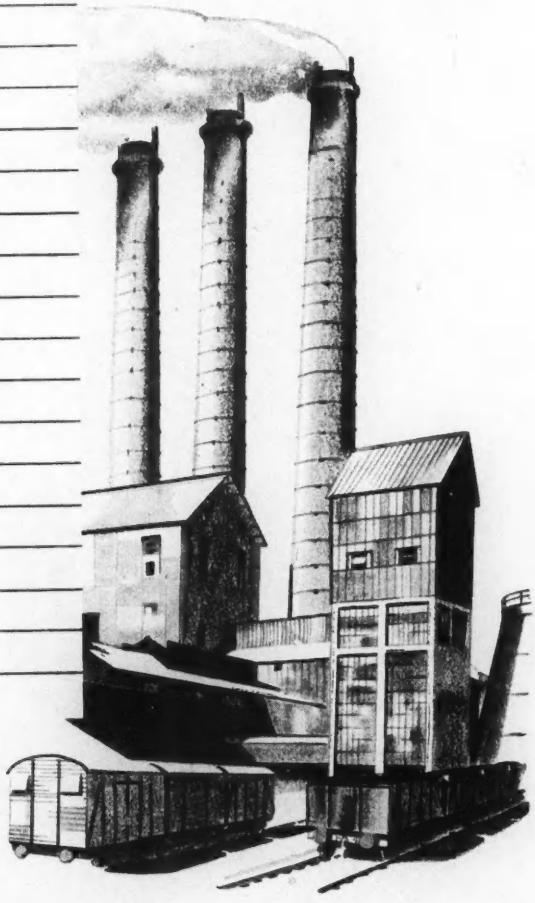

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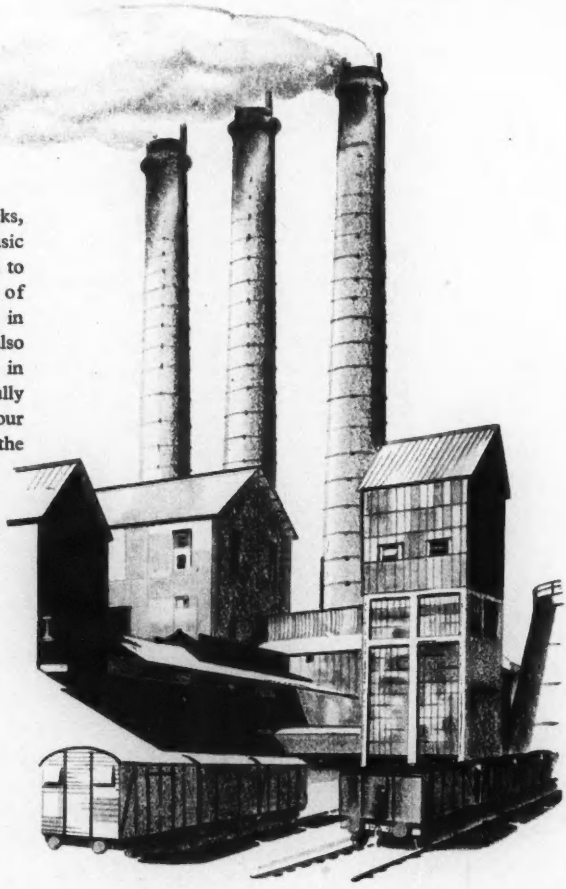

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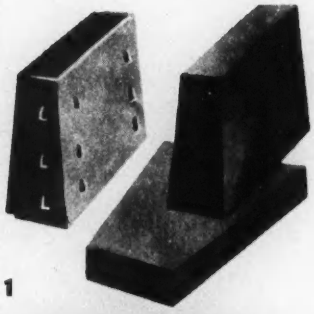

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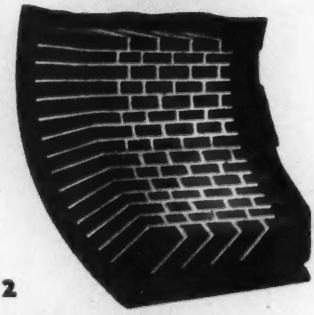

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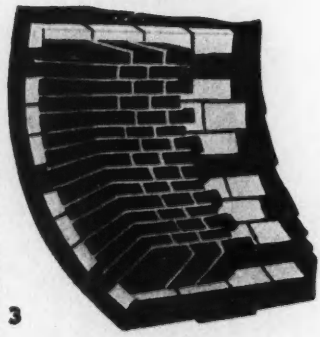

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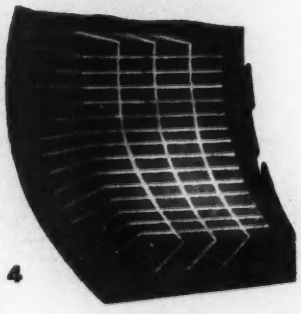

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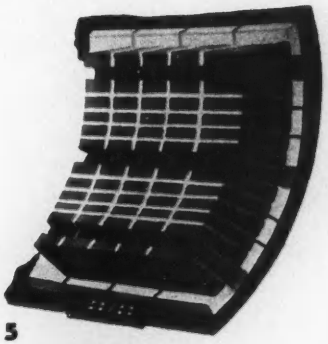

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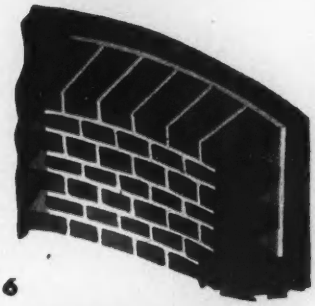

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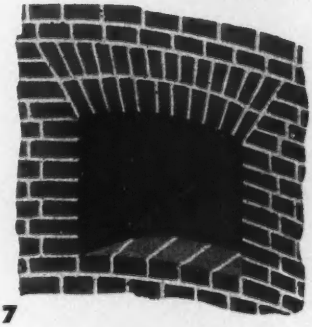

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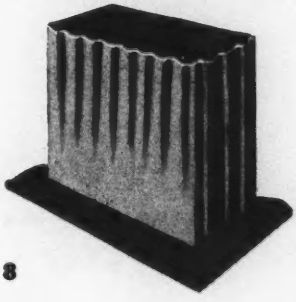

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RADEX-MU: Chemically-bonded magnesite-chrome brick (without metal casing). Same properties as Radex SK brick. Is mainly used in burning zones of rotary and shaft kilns. Metal sheets or special magnesite mortar mixed with silicate of soda are recommended for jointing.

RADEX-EZ: Fired magnesite-chrome brick, highly refractory, resistant against the action of basic slag. Possesses great cold crushing strength, resistance against temperature fluctuations, low thermal conductivity. Promotes the formation of clinker coating. Is mainly used in intermediate and clinker zones of rotary kilns. Metal sheets or special magnesite mortar mixed with silicate of soda are recommended for jointing.

RADEX-B: Fired special magnesite brick, made of electrically-fused magnesite without extraneous admixtures. Resistant against temperature fluctuations and the action of basic slag. Possesses excellent refractoriness, great cold crushing strength, and resistance against abrasion. Mainly used in burning zones of cement kilns, particularly in kilns producing white Portland cement, but is also used for feeding zones of shaft kilns.

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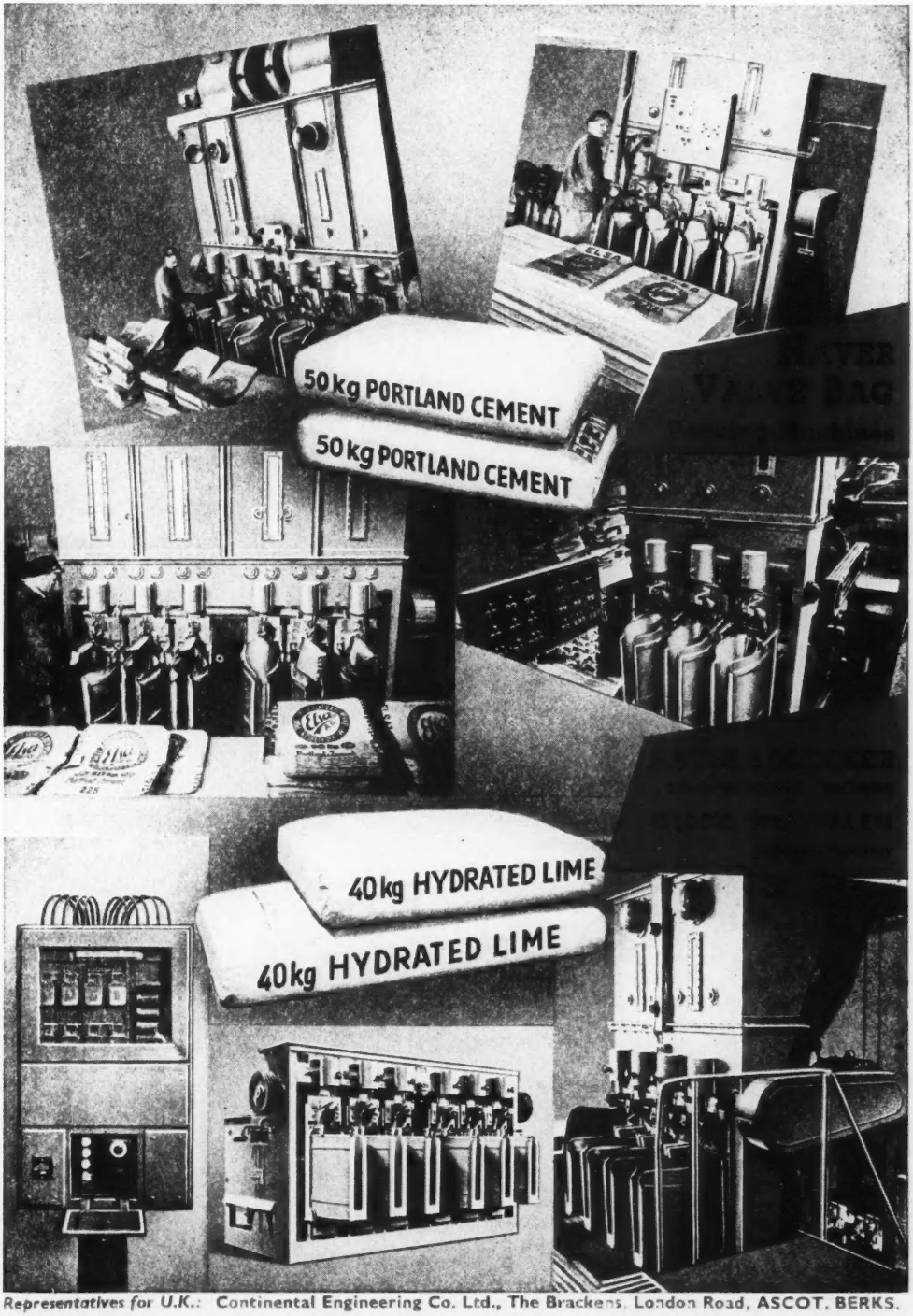

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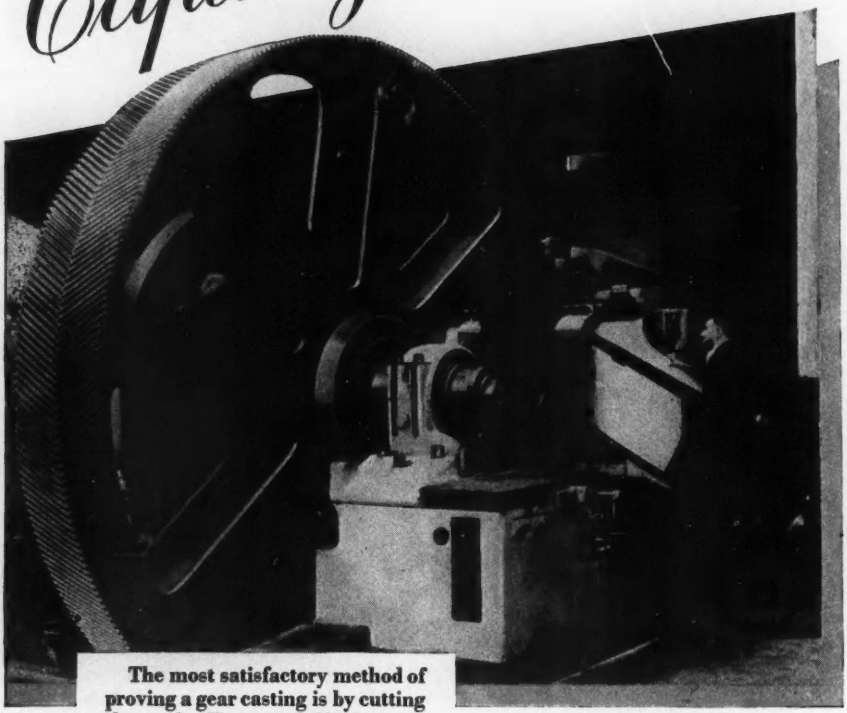

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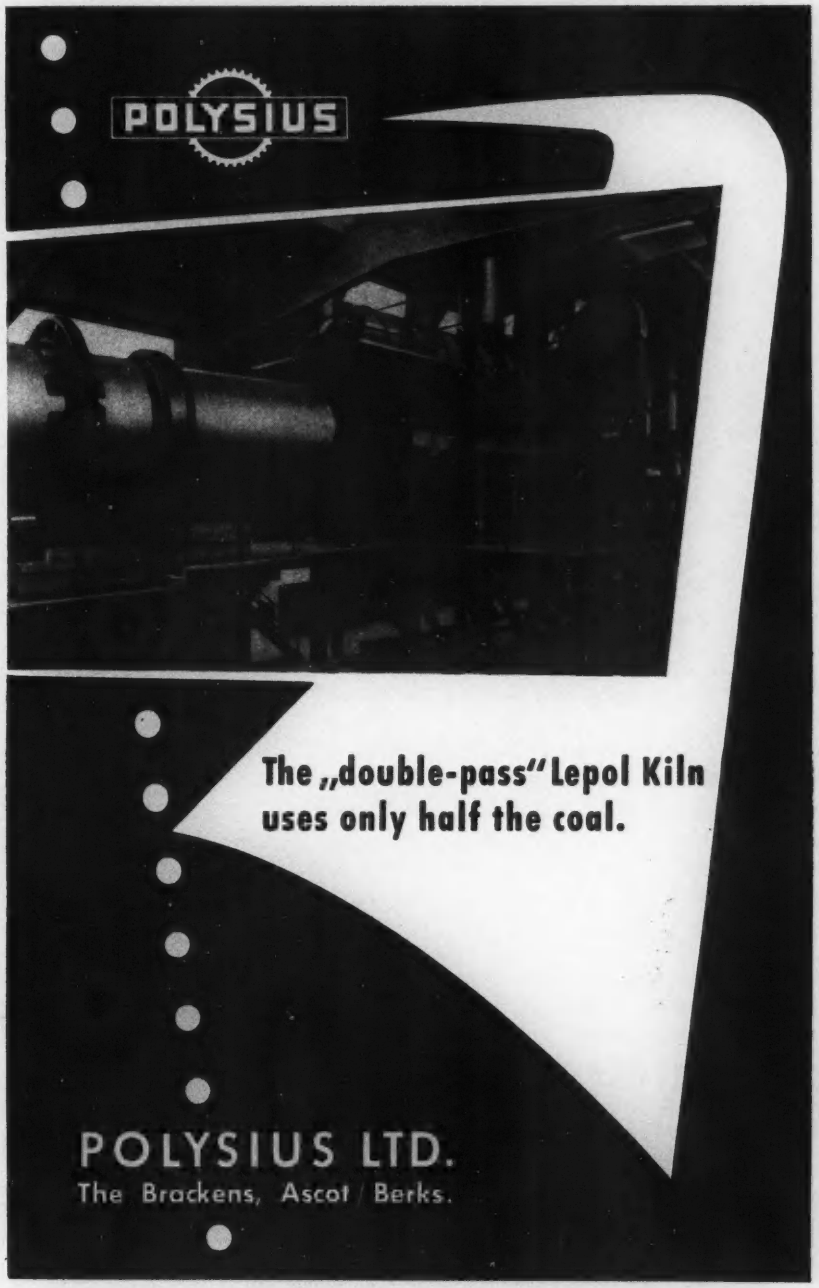
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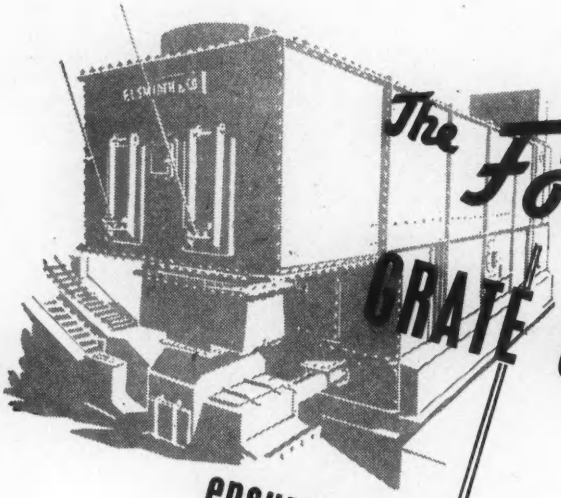

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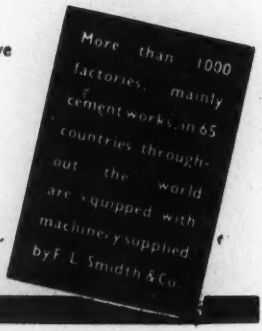

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VOLUME XXIX. NUMBER 5. SEPTEMBER, 1956

The Pelletisation of Raw Materials.

For the efficient production of cement by the dry process, in the air-suspension type of vertical kiln, or on moving grates, the quality of the granulation of the raw material determines the efficiency of heat transfer and consequently the fuel consumption and output, the dust loss, the uniformity of the burning of the clinker, and other factors. In recent years the importance of granulation has been increased by using filters for the slurry and pelletising the slurry "cake" from the filters. By this means a high thermal efficiency can also be achieved. Further, the dust recovered from the flue gases may be reintroduced into the kiln after granulation and adjustment of its chemical composition.

According to an article in the Russian journal "Tsement" (1955, No. 6) by E. I. Hodorov and W. A. Nelidov, the process of granulation of hydrophobic powders whose molecules have more affinity to water than water molecules have to each other can be represented as follows. The powder, consisting of particles of different sizes, is wetted. In the process of granulation the distribution of moisture among the particles is not uniform. As they move around in the granulating pan the particles that become wetted tend to agglomerate as a result of surface tension of the liquid film covering them, the particles within the agglomerates are compressed by an amount corresponding to the thickness of the layer of liquid surrounding the granules, and free liquid concentrates on the surface of the granules (*Fig.* 1a).

(1) After prolonged stirring the amount of liquid on the surface of the granules diminishes and reaches an amount corresponding to the monomolecular liquid layer, when the granules cease to increase in size, their strength due to the cohesive forces of the liquid and solid molecules reaches a maximum, and their liquid content is at its optimum. Thus the maximum size of a granule depends on the maximum quantity of liquid in it, either at the time of its formation (for a given ratio of powder to liquid this is determined by the mixing conditions and the fineness of the liquid spray) or which has accumulated on it during granulation.

The uniformity of the granules is therefore related to the uniformity of the sizes of the particles of the dry material. If, however, the period of granulation is short, the size and strength of the granules may not reach their maximum.

(2) In another granulating condition the amount of liquid in the granules may be higher than its optimum value. In this case the granules may be larger but their strength is likely to be less than its optimum value. The period of granulation has the same effect as in (1).

(3) If the average liquid content of the granules is lower than its optimum value only partial granulation will take place, and, compared with (1), the granules will be smaller. The strength of the granules and the other conditions of granulation will be as in (1). Consequently the formation and growth of the granules are determined primarily by the presence on their surface of free liquid. The

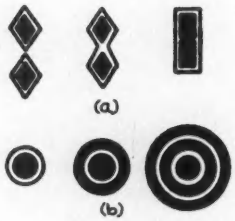
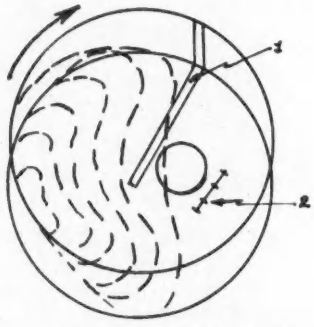


Fig. 1.



1.—Scraper. 2.—Water Jets.

Fig. 2.

surface tension of the liquid and the weight of the granules also contribute to efficient granulation; the better this relationship the easier the granulation.

The granules should have sufficient strength when they are formed and also during preheating. The strength of granules under operating conditions, other factors being equal, depends on the plasticity of the material.

Plastic material of colloidal structure that is easily dispersed has very much better wetting properties, and its granulation is much more efficient, than material of a more crystalline nature. Granulation of more crystalline material can be improved by finer grinding, but this has little effect on the strength of granules under burning conditions. Grinding finer than 2 per cent. residue on a sieve with apertures of 19 microns leads to a reduction in the strength of the granules. If the mineralogical structure is not favourable for efficient granulation it can be improved by adding plasticising materials such as clay (3 to 5 per cent.) or sulphite liquor (0.5 to 2 per cent.). Good results were obtained also with additions of 1 per cent. of sodium chloride and 1 per cent. of sodium carbonate.

In 1952 tests were made on pan granulators of 3 m. and 1 m. diameter. The

powdered material was wetted when it was in the pan as opposed to the other usual practice of wetting it prior to its entry into the pan. In 1953 and 1954 a pan granulator 3 m. in diameter with a capacity of 20 to 25 tons of dry material per hour was tested under operating conditions. A pan granulator consists essentially of a pan with a high rim, inclined to the horizontal, and driven by a central drive. The dry material can be wetted either in the pan or in the feed-pipe before it enters the granulator. If the liquid and the dry powder are mixed in the feed-pipe, the movement of the material under the action of the rotating pan results in considerable differences in the size of the granules; in this case, if no further additions of dry material and water are made, various sizes and types of granules accumulate in the lowest part of the pan which, during further granulation, leads to non-uniformity

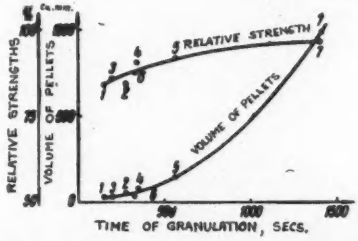


Fig. 3—Strength and size of pellets as a Function of the Period of Granulation.

Pan 1m. diameter. Raw material, chalk and clay. Moisture content of pellets, 11 to 12 per cent. Test Nos. 1 to 6 in Table I.

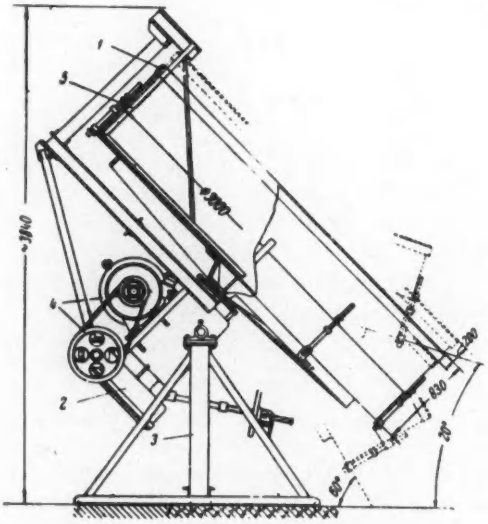
of the final product. Wetting of the powder in the pan results in more uniform conditions and therefore a more uniform size of granule.

As a result of centrifugal force due to the rotation of the pan and the weight of the material, the granules are lifted to a certain height and fall at an angle depending upon the inclination of the pan. The material has a maximum height equal to that of the rim of the pan, and occupies between two and three quadrants of the bottom of the pan (*Fig.* 2). The material is introduced to the part of the pan unoccupied by the material, and at the same time sprayed with water. The larger the granules, that is the nearer they are to their final size, the less is the friction between the granules and the ungranulated material, the smaller is the height to which the granules are lifted by the rotary motion, and the sooner they are discharged over the rim of the pan. In this way the larger granules tend to circulate over a comparatively small area of the bottom of the pan and the smaller ones are lifted and circulated over a wider area of the pan, exposed to further water spraying, and lifted again by the rotation of the pan, leading to an increase in the size of the granules (*Fig.* 1b).

Experimental results of the relation of the size and strength of granules to the time of granulation and the quantity of material fed into the granulator in unit time are shown in *Fig.* 3. For a given output, and consequently for a given

TABLE I.

TEST No.	RAW MATERIAL % residue on 90 μ sieve	PAN				OUTPUT (Kg. per hour)	AMOUNT IN PAN (Kg.)	AVERAGE TIME OF GRANULATION (Seconds)	GRANULES			
		Dia. (m.)	Height of rim (mm.)	Angle of pan (Deg.)	Speed (R.P.M.)				Average dia. (mm.)	Average volume (Cu. mm.)	Relative strength %	Moisture content %
1	3·84	1	80	40	42	169	6·6	141	3·8	29·6	83·7	11·8
2	3·84	1	80	35	25	153	11·7	275	4·9	61·2	84·3	12·0
3	10·00	1	135	50	42	154	8·4	197	3·9	31·0	86·0	11·0
4	10·00	1	135	40	42	168	15·9	340	5·4	83·7	80·3	10·6
5	10·60	1	135	35	14	163	25·6	566	6·5	141·0	91·7	11·9
6	3·84	1	180	50	25	144	14·6	321	4·3	40·5	88·0	11·9
7	10·00	1	180	35	14	165	64·8	1410	12·3	975·0	96·0	11·6
8	3·84	1	80	35	14	170	–	–	4·3	40·0	67·4	11·1
9	3·84	1	80	35	14	170	–	–	4·8	57·0	64·4	13·4
10	3·84	1	80	35	14	170	–	–	6·5	146·0	55·0	14·0
11	4·00	1	135	40	25	150	–	–	4·5	53·0	90·2	12·5
12	10·00	1	135	40	25	184	–	–	4·5	46·0	88·5	11·5
13	24·00	1	135	40	25	152	–	–	4·7	55·0	85·6	11·6
14	17·00	3	830	45	9	29,000	–	–	21·4	5075·0	–	10·3
15	17·00	3	830	50	10·5	17,000	–	–	11·3	755·0	–	9·8



1, Pan. 2, Reduction gear. 3, Regulator for Angle of Inclination. 4, Transmission. 5, Scraper.

Fig. 4.

diameter of pan, the quantity of material in the pan, the time of granulation, and the size and strength of the granules can be increased by reducing the inclination of the pan and increasing the height of the rim. This is confirmed by the experimental data shown in *Table I*. Variation of the inclination of the pan is possible only from 35 deg. to 55 deg., the lower limit being the angle of repose of the material, otherwise some of the material tends to remain stationary and hinders granulation. The steeper the angle of inclination and the lower the rim the higher should be its peripheral speed so as to decrease the size of the granules and to protect their formation and strength. The peripheral speed should be about 1·6 m. per second. It has been recommended* that if the height of the rim in metres be assumed to be proportional to the square of its diameter D (for diameters between 2 m. and 3 m.), the required speed can be calculated approximately from $H = 0{\cdot}1 \times D^2$. The output of the granulator can be calculated from $G = 0{\cdot}35 \times D^4 \times \mu$ in which G is the output of the pan in kilogrammes per hour and μ is the density of the granules in kg. per cubic metre. The power consumption N of the granulator in kilowatt tons is given by $N = 8 \times 10^{-6} \times D^5 \times \mu n \times \sin \alpha$, in which n is the number of revolutions of the granulator per minute and α is the inclination of the pan in degrees.

In tests of the granulator with a diameter of 3 m., shown in *Fig.* 4, the material was 88 to 90 per cent. of marl (dry weight) and 10 to 12 per cent. of coal (dry weight) ground to a fineness of 17 per cent. residue on a sieve with apertures of 90 microns. The inclination of the pan to the horizontal was 45 deg., the number of revolutions 9 per minute, and the height of the rim 830 mm. Scrapers were fitted on the rim immediately before the feed-pipe. Water at a pressure of 2 atmospheres was directed by five jets tangentially to the material as it entered the pan. The test confirmed the possibility of granulating 20 to 25 tons of material per hour and of obtaining uniformly strong granules in sizes of 4 mm. to 5 mm. and 25 mm. to 30 mm. Automatic regulation of the process, resulting in the classification of the granules according to their size, ensured uniformity of the granules, and conveniently differentiated between this type of granulator and the drum granulator. It is a feature of the pan granulator that it enables the size and strength of the granules to be regulated within a considerable range. One of the basic requirements of successful granulation in a pan machine is proper regulation of the delivery of the dry material and of the water.

*K. Meyer, Zement-Kalk-Gips, 1952, (6) pp. 175-179. W. Anselm, Zement-Kalk-Gips, 1952, No. 2.

Proposed Cement Works in Thailand.

The Royal Irrigation Department of Thailand proposes to build a cement works in that country, as the two existing Government cement works, with a capacity of 400,000 tons a year, cannot meet the requirements for cement in Thailand.

Cement Subjected to High Pressure.

THE results of an investigation into the behaviour of cements subjected to high hydrostatic pressures are described in a paper by Mr. C. E. Weir, Mr. C. M. Hunt and Mr. R. L. Blaine in Research Paper No. 2646 of the U.S. National Bureau of Standards published in the Bureau's " Journal of Research " for January, 1956.

The authors state that in considering studies of the pore-size distribution in hardened cement pastes by the mercury porosimetry methods data are required on the magnitude of the compression of the cement when subjected to hydrostatic pressures. Normally the compression of the cement paste would be considered to be negligible, but a study by mercury porosimetry of the extremely small pores believed to exist in dried cement paste would require rather high pressures at which the change in volume of the paste might well be of significance. While the elastic properties of concrete have been studied extensively, the measurements were conducted almost exclusively at low pressures and only rarely on neat cement. However, the elastic properties of the rocks and minerals that may be used as aggregates in concrete have been investigated widely at extreme conditions of temperature and pressure, primarily because of geological interest.

Because concrete is subjected to moderately high compressive stresses in many commercial applications it appears that there is little direct evidence—apart from successful usage—that the aggregate and the neat cement are compatible as regards compressibility. In order to obtain direct evidence on this question, as well as to evaluate the corrections required in high-pressure-mercury porosimetry studies, preliminary data were obtained on the compression of hardened cement pastes with available high-pressure equipment. These data showed evidence of a transition at elevated pressures in wet cement and indicated the desirability of a detailed study of the compressibility of cement itself, irrespective of any immediate significance of the data in direct applications.

Compression studies were made on hardened cement pastes at 21 deg. C. and at pressures as high as 10,000 atmospheres. The effects of composition, age, moisture content and water-cement ratio were studied. Compressibility of dried Portland cement pastes appeared to proceed to a maximum value with increased curing, the existence or location of the maximum being dependent on the water-cement ratio. Compressibility of both Portland and high-alumina cements increased with increasing evaporable water content. Portland cements with evaporable water contents in the range of 17·5 to 32·4 per cent. exhibited a transition between 2000 and 3000 atmospheres. No similar effect occurred in high-alumina cement. Experiments indicated that the transition was attributable to hydrated lime formed in the Portland cement. Average compressibilities of dried paste were $3 \cdot 1 \times 10^{-6}$ and $2 \cdot 2 \times 10^{-6}$ atm^{-1} between 1 and 5000 atmospheres and between 5000 and 10,000 atmospheres respectively. Compression studies were also made with wet silica gel, hydrated tricalcium silicate, and dry and wet calcium hydroxide.

Short Kilns with Pelletiser and Travelling Grate.

A PILOT plant has been built at Carrollville, Milwaukee, U.S.A., by the Allis-Chalmers Manufacturing Company for testing and developing new materials and processes by the ACL (Allis-Chalmers Lellep) process consisting of a pelletising plant, a travelling grate for drying and partially burning the pellets, and a short kiln. The pilot plant (*Fig.* 1) has a capacity of 300 to 400 lb. per hour; commercial plants vary in capacity from 10 to 30 tons per hour. The general arrangement of the pilot plant is shown in *Fig.* 2. The commercial kilns are 120 ft. to 175 ft. long, with inside diameters from 10 ft. 6 in. to 13 ft.

The pelletising process maintains the original proportions of the various components and prevents segregation of the finely-ground raw materials, with

Fig. 2—The Pilot Plant

the result that fuel consumption is low, there is less loss of dust, and burning conditions are more uniform. The pelletiser (*Fig.* 3) is of the pan type, in which finely-ground dry material is converted into ¼-in. to ¾-in. pellets by the addition of 12 to 14 per cent. of water. The pan has a slope of about 60 deg. and rotates at about 12 revolutions per minute. The fine material filters down through the charge in the pan and remains at the bottom until pellets are formed and begin to increase in size and rise to the top to be discharged over the rim of the pan when they are of the required size.

A short conveyor delivers the pellets to a hopper over the grate (*Fig.* 4) from which they pass on to the travelling grate in a layer about 6 in. deep, the

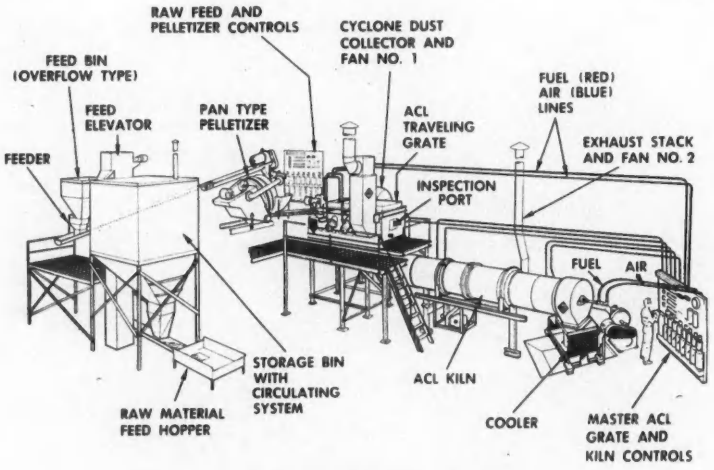


Fig. 2.—Arrangement of Pilot Plant.

Fig. 3.—The Pelletiser.

height being controlled by a cut-off plate across the width of the grate. Essentially the grate consists of a slowly moving conveyor, made of chains and castings (similar to a stoker grate). The enclosure of the grate is divided by baffles into drying and heating chambers. The pellets first enter the drying chamber where they are exposed to a downdraught of gases at a temperature of 500 to 600 deg. F. so that they will be dry when they reach the heating chamber, where they are exposed to hot kiln exit gases at temperatures from 1700 to 1800 deg. F. and are partly calcined before they enter the kiln. The final burning takes place in the rotary kiln, and the hot clinker discharged from the kiln, still in the form of pellets, is cooled and ground.

The dust loss of less than 1 per cent. of the weight of the raw material is due to the presence of three dust-recovery points in the system, one in the drying chamber, one in the heating chamber, and one in the cyclone collectors. It is claimed that no further dust-collection system is necessary except in the case of plants in urban areas.

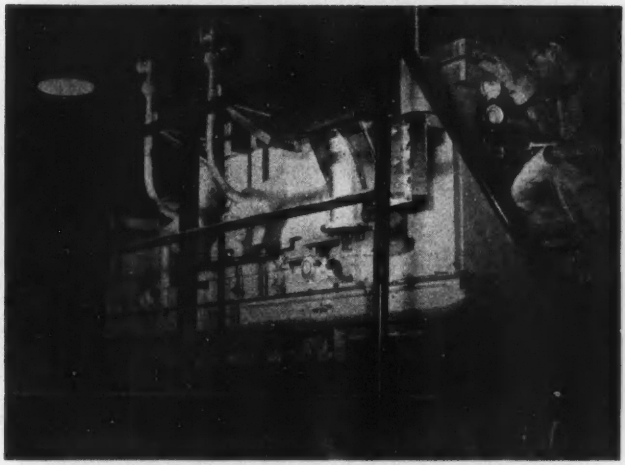


Fig. 4—The Travelling Grate over the Feed End of the Kiln.

Clinker has been produced in the pilot plant with a fuel consumption of about 700,000 B.Th.U. per barrel (4,200,000 B.Th.U. per ton). The exit-gas temperatures are from 200 to 250 deg. F. At the pilot plant barrels of raw material are emptied into the feed-box, under which a screw-conveyor takes it to an elevator which delivers it to a small overflow-type feed-bin above the rotary feeder for the pelletiser. The overflow from the small bin is returned to the larger bin, from which it is recirculated in the circuit. The pelletiser is 3 ft. 3 in. diameter and 12 in. deep, and has scrapers to prevent the material adhering to the bottom and side of the pan. The slope and speed of the pan and the supply of material

and water can be varied. The pellets are discharged on to a short inclined belt which takes them to the feed-box of the grate, which is 18 in. wide. A control panel near the discharge end of the kiln indicates the draught and temperature conditions, and the flow of gas to the burner. A separate panel near the pelletiser is provided for all equipment up to and including the pelletiser.

In the pilot plant the temperature of the kiln exit gases above the grate is 1720 deg. Fahr., the temperature of the gases after passing through the pellets in the heating chamber is 470 deg. Fahr., and after the second passage through the pellets the temperature of the gases is 210 deg. Fahr.

Pelletising Cement Materials.

A METHOD of making nodules for use in the burning of cement is described in a British patent (No. 719,712, October 31, 1952) granted to the Amalgamated Limestone Corporation, Ltd.

In this method a mixture of fuel and raw material for cement is fed from a hopper (1) into a paddle mixer (2) to which water is supplied from a tank (3). The mixture is fed down a chute (4) between a peripherally-grooved roller (5) and a plain roller (6). The strips thus formed are removed by a comb (7) and fed to a rotary drum (9) where they are rolled to form nodules.

In a modification (Fig. 2), rubber belts (12) pass over the roller (5) and the strips cling to the belt until the direction of the belt is changed at (13), when the strips fall into the nodule-forming drum. Brushes (16, 17) clean the grooves in the roller (5) and the belts (12) respectively. The plain roller (6) may be heated to prevent the material from sticking to it, or it may be made of or covered with rubber. The strips may be cut into short lengths before entering the drum.

FIG. 1.

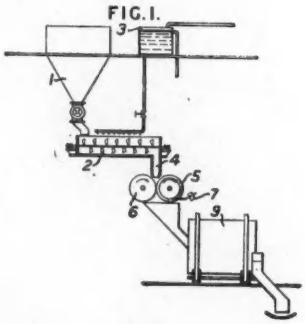
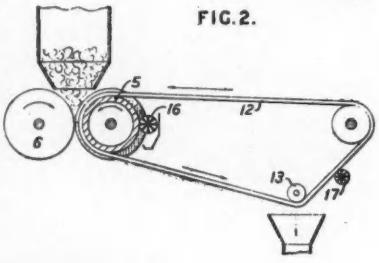


FIG. 2.



Cement Production in Belgium.

In the years 1951 to 1954 the production of cement in Belgium fluctuated as follows (1953 production = 100): 1951, 95; 1952, 89; 1953, 100; 1954, 95.

Cement Production in Colombia.

The production of cement in Colombia in the year 1955 was 1,047,000 metric tons.

New Cement Works in Costa Rica.

The government of Costa Rica has invited tenders for the erection of a cement works in the Lourdes de Aguascalientes area.

Effect of the Shape of Alite Crystals on the Early Strength of Portland Cement.

THE effect of the size and shape of alite crystals on the rate of development of strengtn of Portland cement is discussed by J. Grzymek in " Silikat-technik " 1955, 6 (7), pages 296-302. This investigation included tests in which alite crystals were obtained under conditions permitting close control of their growth in supersaturated solutions. The purpose of the tests was to prepare alite crystals small in size and particularly with a small ratio of the vertical to the horizontal axes.

A comparison of compressive strengths of two chemically-identical cements but containing alite of different sizes showed that the cement with smaller alite crystals had a considerably higher early strength than that of normal Portland cement. Tests were made with two cements, namely (1) with alite crystals of

TABLE I—Depth (in Microns) of Penetration at Various Ages.

Clinker compound	Curing time in days.				
	1	2	3	7	28
C_3A	4·70	5·20	5·68	5·70	
C_3S	2·25	3·02	3·60	4·32	6·10
C_2S	0·28	0·40	0·50	0·62	

TABLE II—Comparison of Theoretical and Experimental Strengths.

Time (days)	h	ΔP	Compressive strength in kg. per sq.cm. (lb. per sq.in. in brackets.)			$\frac{P}{P_s}$	$\frac{P}{P_s}$ average
			P_n	P_s	P		
1	2·25	2·40	60 (854)	145 (2070)	140 (2000)	0·97	0·99
2	3·02	2·22	110 (1570)	244 (3480)	231 (3290)	0·94	0·96
3	3·60	2·06	155 (2210)	320 (4550)	294 (4190)	0·92	0·91
7	4·32	1·85	280 (3980)	515 (7330)	391 (5560)	0·76	0·77
28	4·44	1·80	415 (5910)	760 (10,800)	447 (6360)	0·59	0·62

h, depth of hydration in microns; △P, increase of strength due to change in axis-ratio of special cement compared with ordinary cement; P_n, strength of mortar with ordinary cement; P_s, calculated strength of mortar made with special cement (alite = 15 microns, axis-ratio = 1·5); P, experimental strength of mortar made with special cement.

15μ and an axis ratio of 1·5, and (2) normal Portland cement with alite crystals of 40μ and an axis ratio of 1 : 1. Both cements contained about 60 per cent. C_3S, 12 per cent. C_3A, 8 per cent. C_4AF, and 20 per cent. C_2S. It was assumed that C_4AF and C_2S had no influence on hydration during the first few days of curing. The cement containing alite in smaller crystals tended to hydrate quicker than the other cement. The actual depth of hydration of the various clinker compounds is shown in *Table I*.

The results of the compressive-strength tests on both cements are given in *Table II*. The difference between the calculated and experimental compressive strengths is noticeable, starting with the second day of curing. This is ascribed to the inhibiting effect which the initially hydrated layer of the cement particles exerts on the further course of hydration. This reduction of the speed of hydration, which results in lower early strength, can be reduced or overcome by reducing the size of the alite crystals and by modifying their axis-ratio or by making additions to the cement so as to break the hydrated layer on the cement particles and thus enable the process of hydration to proceed throughout the particles.

Results similar to those obtained under laboratory conditions can be produced in actual clinker burning by adjustments in the burning conditions, the choice of the raw materials, or by special additions to the raw meal. These investigations appear to offer some explanation of the fact that in some cases cements of apparently identical composition have considerable differences in their early strengths.

New Cement Works in Honduras.

The government of Honduras has decided to build a cement works with a capacity of 150 tons of cement a day. It was originally proposed that the works should have a capacity of 100 tons a day, and tenders have already been received for this works. (See also page 72.)

Proposed Works Extension in Spain.

It is reported that the Iberia Portland cement concern has applied for permission to extend its works by the addition of a new rotary kiln and two grinding mills, at a cost of 20,000,000 pesetos. The new plant would be imported.

Proposed Cement Works in the Gold Coast.

The Ministry of Trade and Labour of the Gold Coast has agreed to the construction of a cement works at Takoradi using limestone from Bonyere, Western Nzima. It is hoped that a foreign cement making concern will collaborate with the Government in the scheme.

Cement Production in Israel.

It is reported that the output of the Nesher cement works in Israel in the year 1955 amounted to 456,000 tons, of which 156,000 tons, an increase of 16 per cent. over 1954, were exported. It is hoped that production will shortly commence at the Shimshon Palestine Portland Cement Company's works at Hartuv, which has a capacity of 250,000 tons a year.

Safety Precautions in Tipping Materials.

IN view of the possibility of accidents occurring at tips due to vehicles driven over the edge, or overturning when near the edge, the Cement Makers' Federation has issued an illustrated brochure showing recommended safety precautions. Some of these are as follows :

(1) Stopping and emptying the vehicle at a safe distance from the edge of the tip, and using a bull-dozer to push the material over the edge.

(2) Fixing a stake firmly in the ground at a suitable distance from the edge of the tip and securing to it a chain that can be attached to the back of the vehicle before it is emptied.

(3) Placing a baulk of timber at the edge of the tip, and securing it with chains to stakes driven into the ground at a suitable distance from the edge of the tip. The rear wheels rest against the timber when the vehicle is being emptied, and the position of the timber stop can be changed as necessary by moving the stakes.

(4) Fixing a wooden stop-block to a steel plate laid on the ground and of sufficient area to accommodate the rear wheels of the vehicle without settling;

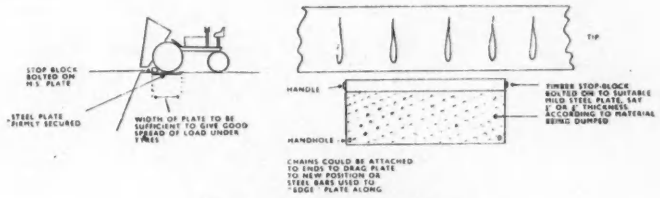

STOP BLOCK BOLTED ON M.S. PLATE
STEEL PLATE FIRMLY SECURED
WIDTH OF PLATE TO BE SUFFICIENT TO GIVE GOOD SPREAD OF LOAD UNDER TYRES
TIP
HANDLE
HANDHOLE
TIMBER STOP-BLOCK BOLTED ON TO SUITABLE MILD STEEL PLATE, SAY 1" OR 2" THICKNESS, ACCORDING TO MATERIAL BEING DUMPED
CHAINS COULD BE ATTACHED TO ENDS TO DRAG PLATE TO NEW POSITION OR STEEL BARS USED TO "EDGE" PLATE ALONG

Fig. 1—Timber Stop-block.

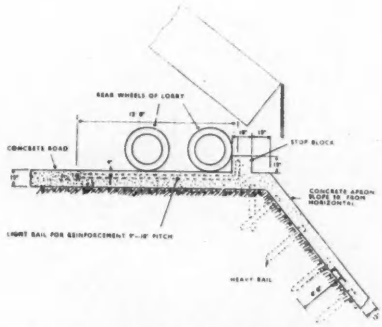


Fig. 2—Reinforced Concrete Platform and Stop-block.

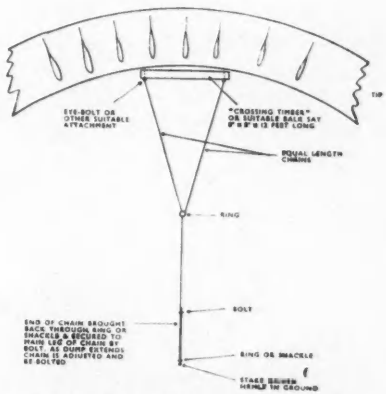

TIP
EYE-BOLT OR OTHER SUITABLE ATTACHMENT
"CROSSING TIMBER" OR SUITABLE BALK SAY 9" x 9" x 12 FEET LONG
EQUAL LENGTH CHAINS
RING
BOLT
END OF CHAIN BROUGHT BACK THROUGH RING OR SHACKLE & SECURED TO MAIN LEG OF CHAIN BY BOLT, AS DUMP EXTENDS CHAIN IS ADJUSTED AND RE-BOLTED
RING OR SHACKLE
STAKE DRIVEN HEAVILY IN GROUND

Fig. 3—Stop-block for Curved Tip.

the weight of the vehicle on the plate will prevent the stop from moving when the wheels push against it. (This is shown in *Fig.* 1.)

(5) Instead of the steel plate described in (4), two skid-plates (say 14 in. wide wide by $\frac{3}{4}$ in. thick) may be fixed to the wooden stop-block to act as tracks for the rear wheels of the vehicle, and the stop-block anchored to stakes by means of wire stays. A winch may be provided to haul the vehicles in case the wheels become bogged at the edge of the tip.

(6) At a permanent tip a reinforced concrete stop as shown in *Fig.* 2 may be used, the reinforcement in the ground slab being turned up into the stop-block.

(7) Where the edge of the tip is roughly semi-circular in plan, an arrangement such as is shown in *Fig.*3 may be used. This comprises a timber stop-block bolted to a steel plate and secured to a stake by chains, and the block can be swivelled to different parts of the edge of the tip.

Accident Prevention.

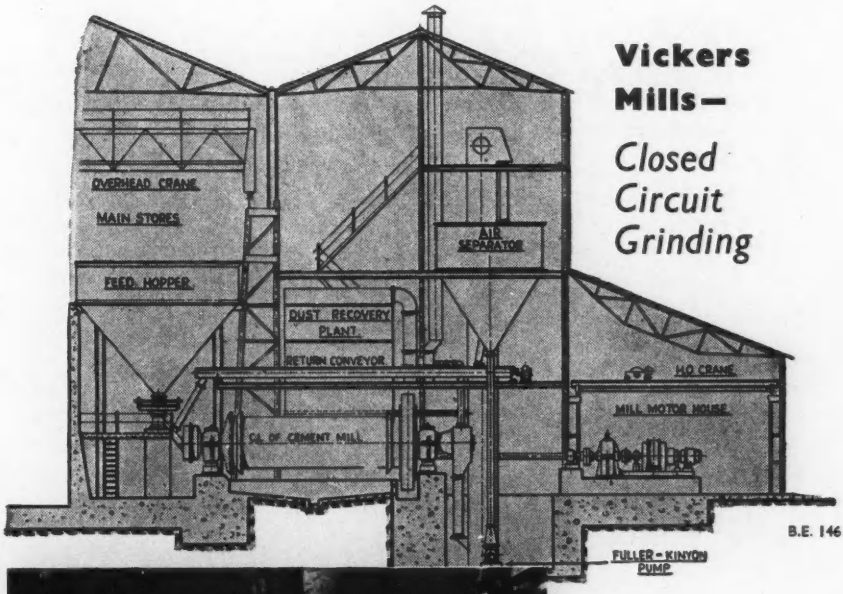
The report of the Accident Prevention Advisory Committee of the Cement Makers' Federation for the year 1955 shows that there were 392 accidents in 44 cement works in the year 1955 compared with 544 accidents in 43 works in the year 1951 when the Committee was formed. Most accidents were ascribed to "human failings," such as tripping, slipping, striking, and handling, and the ratio has varied very little in the past five years; 69 per cent. of all accidents were due to these causes in 1951 and 1952, 71 per cent. in 1953, 74 per cent. in 1954, and 71 per cent. in 1955. The highest monthly rate of accidents is in October, but it appears that a special campaign in September last year has effected much improvement, as there were only 32 accidents in October 1955 compared with 52 in October 1954. Five works have had an accident-free year during the past five years, and one works (Barnstone) has had no accidents during the five years. There were three fatal accidents in the industry last year, as follows: (1) A man who was assisting in loading lorries from an excavator was struck and received fatal injuries when a lorry backed; (2) the driver of a diesel-engined vehicle was killed when the flywheel suddenly disintegrated; (3) a man was found dead beside a revolving mill ; the circumstances leading to the accident are not known.

Proposed Cement Works in Nigeria.

It is proposed to build a cement works in Western Nigeria, where it is thought that sufficient raw materials are available.

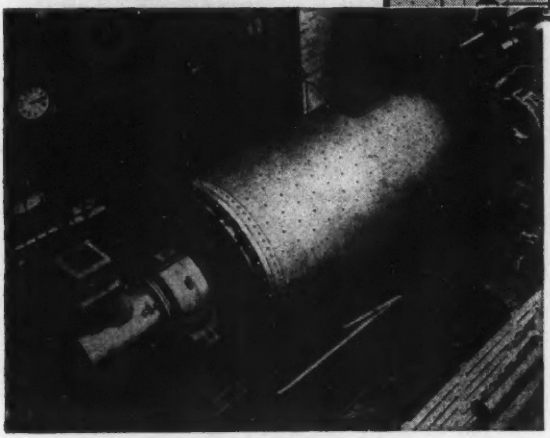
Cement Works in Belgian Congo.

A new cement works, with an annual capacity of 30,000 tons, is to be built near Lake Kiru by a new company called Societé de Ciments du Kiru.



Vickers Mills—

Closed Circuit Grinding



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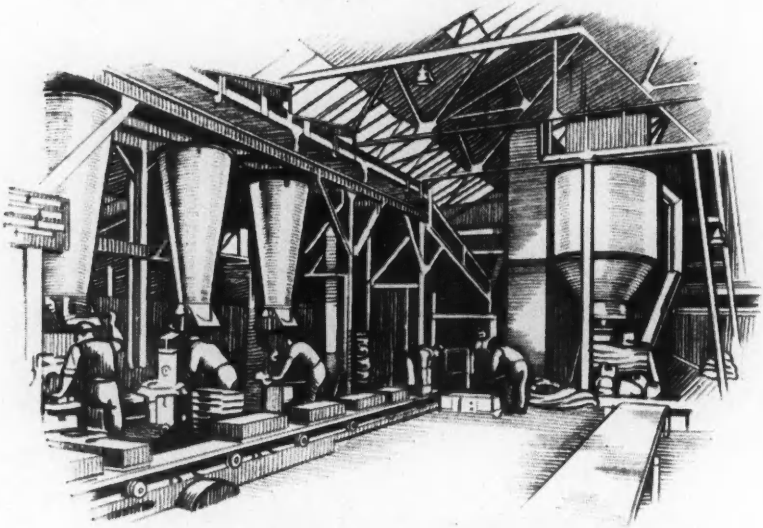

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The Associated Portland Cement Manufacturers, Ltd.

THE following is an abstract of the statement made by the Chairman, Sir George Earle, C.B.E., at the annual general meeting of the Associated Portland Cement Manufacturers, Ltd., held in London last month.

The dividend for the year 1955 was 22½ per cent. Expressed as a percentage of the capital invested in the business this equals 8.8 per cent., which was lower than the figure of 10·2 per cent. before the war. Comparison with other businesses in this country and oversea indicated that, on this basis, the Company was working on a narrower margin of profit than was normal. This was perhaps to be expected, as cement in Britain was sold at a lower price than anywhere else in the world. The percentage of the Company's total profit (before provision for taxation) resulting from the sales of cement in Great Britain was 29 per cent.; the remainder of the profit arose from exports of cement, sales of other commodities, dividends from investments at Home and oversea and interest.

PRICE OF CEMENT.—In pursuance of the industry's policy of selling cement cheaply, in December last it was announced that Home prices would not be advanced before June 30 this year. The idea was that if a large proportion of British industry would do the same inflation would receive a check and, instead of wages being advanced, they would become worth more in purchasing power. Although over eighty businesses and industries gave similar undertakings not to increase prices—some until the end of the year—this was not enough to have any practical effect. It probably had a psychological effect, for it showed industry's willingness not only to stress the danger into which the country was running but to take practical steps to avoid it at its own expense. It was hoped that the nationalised industries, whose products in the form of coal, power, and transport formed so large a proportion of all industrial costs, would follow this lead. It was disappointing that at this time trade unions should be pressing for a shorter working week and longer holidays which, if adopted, must increase costs and thus worsen the export position. It was recognised that all must work harder in order to maintain the present standard of living; any shortening of the working week or lengthening of holidays must be directly opposed to this need, and the time had come when such demands must be refused.

THE PRICE OF COAL.—It was a bad blow to their ambition not to raise prices when the National Coal Board increased the price of coal by about 6*s.* a ton from June 1. The cement industry was keen to absorb all the increased costs it could, but this extra cost of coal would amount to about £1,500,000 a year on the Home trade alone. With regret, the Home trade prices were increased by 3*s.* a ton on July 1. This did not apply to export prices. As the National Coal Board had agreed not to advance pit prices for twelve months it had been agreed not to increase the price of cement for the same period unless something exceptional happened. Before the war coal delivered on Thames-side cost 19*s.* 3*d.* a ton and now it was 91*s.* 7*d.*, the pit prices being 12*s.* 9*d.* against 63*s.* 4*d.*, or nearly five

times the pre-war price—this was a frightening figure, for it affected the cost of all production.

RESEARCH.—Expenditure of the Company on research and development in 1955 was over £300,000.

PENSIONS.—An improved workmen's contributory pension scheme was being introduced by which each member would pay 3*s*. 6*d*. per week and the Company would pay the same amount. The initial cost of providing for the past service of the men was £1,250,000, and the whole of the initial cost was included in this year's accounts. The annual payment to be made in future would be about £70,000. In addition the Company would bear the cost of a death benefit of £100 in the case of any full member of the scheme who died in service before normal retirement age.

DELIVERIES OF CEMENT.—Last year the Company's deliveries of cement were more than 300,000 tons higher than in the previous record year of 1954. Exports as well as Home trade increased. But for the dock strike they would have been better; the dock strike last year dealt exports a severe blow, some of the effects of which were probably permanent. Up to the middle of June this year the Company's deliveries of cement were 186,000 tons more than in the same period last year.

(*Continued on page 71.*)

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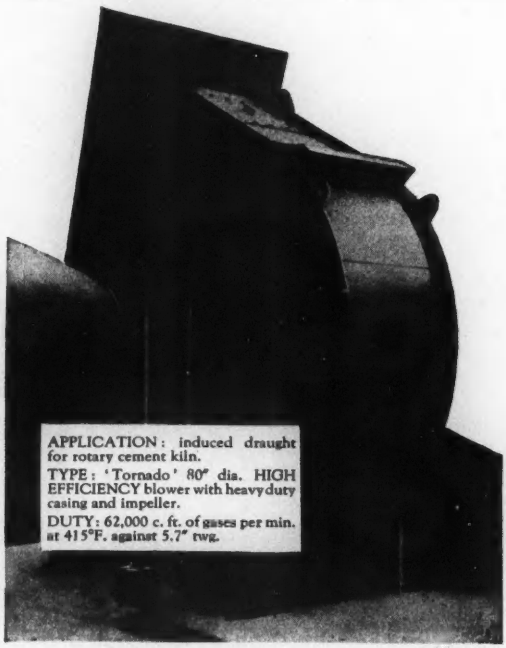

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Alite	Alumina	Refractoriness
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B.1	62-64%	36
B.	57-59%	36
D.	39-42%	33

High-Temperature Insulating Bricks.
"PEER" Air-Setting Refractory Cements.
"R" Quality Firebrick for lower temperature work and resistance to abrasion.

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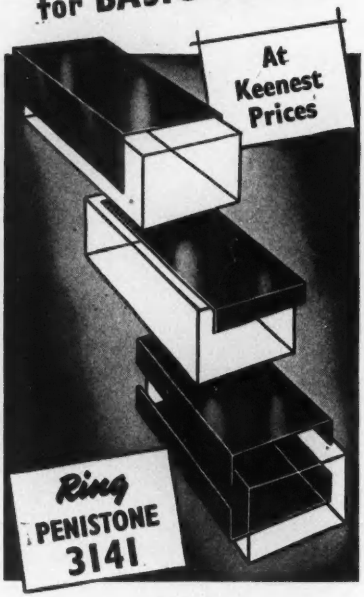

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The new works at Cauldon in Staffordshire should be in production early next year. It was designed so that it could be easily trebled in size.

In 1955 capital expenditure was agreed for improvements in the works and distribution system throughout the United Kingdom amounting to £4,225,000. Production per man-hour in 1955 was higher than it had ever been, and the quality of the products was improved.

OVERSEAS WORKS.—The overseas companies in which they were interested were successful in 1955 with the excepton of the company in Australia, where hopes of a better year were thwarted by floods and strikes. The position caused by continual labour troubles was so serious that this year, when further trouble arose in the quarry, the entire works was shut down. It had now been re-opened and it was hoped on terms that would enable it to operate at full capacity and produce a reasonable return.

In British Columbia record production was attained and a large new grinding mill was being installed, a mainland distribution and packing depot (to which cement would be sent loose) was being built, and a new kiln had been ordered for the Bamberton works. When the new kiln was in operation the output of this works would be 500,000 tons a year. Although this was in excess of the total consumption of British Columbia, it was thought that demand within the next five to seven years would increase sufficiently to absorb this additional production.

(*Continued on page 72.*)

HAZEMAG

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Much time has been spent in Ontario investigating the prospects of establishing a works there, and a decision would be made during this year.

In Kenya the new works was progressing rather slowly, due largely to the shortage of steel, and it seemed unlikely that this works would start producing cement until late in 1957.

In Malaya the company had a successful year, producing more than its rated capacity, and they looked forward to a satisfactory future.

In Mexico the works had been working at full capacity and making reasonable profits. The economies of the third kiln at Tolteca were evident now that it was working to full capacity. It was the intention of the Mexican Company to install another kiln.

In New Zealand the self-discharging ship for carrying loose cement was now operating satisfactorily. The issued capital of the Company was to be doubled from £750,000 to £1,500,000, and new dry-process kilns with a capacity of 200,000 tons a year would be erected at the Golden Bay works.

In South Africa the third kiln at Lichtenburg was operating satisfactorily. The output and the economies of the larger production were satisfactory, and they were also satisfied with the progress in the construction of the new works near Salisbury in Southern Rhodesia which was expected to be in production early next year.

In the Western Region of Nigeria they had found promising indications of limestone, and were investigating the possibility of erecting a cement works in conjunction with local interests.

Cement Standards.

The " Review of the Portland Cement Standards of the World," first issued by Cembureau (P.O. Box 245, Malmö, Sweden), in 1948, has been revised up to the year 1955, and the new edition is now available at 18s. It is stated that standards for Portland blastfurnace and other types of cement will be dealt with in a future publication. The information is given mainly in tabular form and includes the physical and chemical requirements of the various standards and the methods of testing specified in various countries.

Proposed Cement Works in Honduras.

A company entitled Cementos de Honduras, S.A., has been formed for the purpose of building a cement works with a capacity of 150 tons a day. The project is being undertaken with the technical advice of United Nations, and it is expected that tenders will be invited before the end of this year. Enquiries about this project should be addressed to the Commercial Relations and Export Department, Board of Trade, Horse Guards Avenue, London, S.W.1, quoting reference CRE.8720/55.

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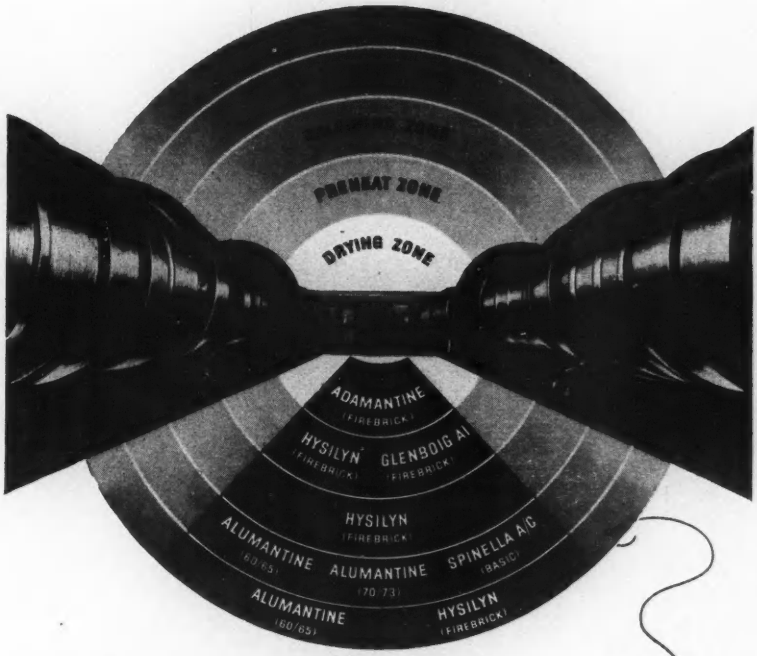
SITUATION WANTED. Plant design engineer, with extensive experience in the design and construction of wet and dry process cement plants, requires suitable post with cement manufacturers or equipment-manufacturing engineers. Box 2115, " CEMENT AND LIME MANUFACTURE," 14 Dartmouth Street, London, S.W.1.



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